December 23, 2013

L-2013-335
10 CFR 50.73

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Reportable Event: 2013-001-01
Date of Event: May 31, 2013

Unplanned Manual Reactor Trip Due to Algae

The attached Licensee Event Report 2013-001-01 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide a supplement to the notification of the subject event.

Very truly yours,

Joseph N. Jensen
Site Vice President
St. Lucie Plant

JJ/rcs
Attachment

IE22
NRR

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION
(10-2010)

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
St. Lucie Unit 2	05000389	1 OF 3

4. TITLE
Unplanned Manual Reactor Trip Due to Algae

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
5	31	2013	2013	- 001 -	01	12	23	2013	NA	
									FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE
1

10. POWER LEVEL
40%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Richard Sciscente - Principal Engineer, Licensing	772-467-7156

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURE	REPORTABLE TO EPIX
B	KE	V	N425	YES	B	KE	V	P340	YES

14. SUPPLEMENTAL REPORT EXPECTED
- ☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)*
- ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On May 31, 2013 at 0712 EDT, St. Lucie Unit 2 was in Mode 1 at 40% reactor power when it was manually scrammed. Unit 2 was scrammed prior to securing the 2A1 Circulating Water Pump (CWP) due to high differential pressure on the debris filter system (DFS) as a result of an algae intrusion. At the time of the trip, the 2A2 Circulating Water Pump had been removed from service for maintenance.

The reactor trip event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as a manual actuation of reactor protection system (RPS). This event had no significant safety consequence. Given the response of the plant and the actions taken, the health and safety of the public was not affected by this event.

The high differential pressure on the 2A1 DFS was the result of the incorrect installation of a debris backwash valve and internal binding of a flush-water check valve. The bound check valve caused a false low DFS transmitter differential pressure that prevented the DFS strainer from initiating a backwash and masked the problem with the debris backwash valve. To correct the problem, the debris backwash valve was properly reinstalled, and the flush-water check valves associated with the DFS differential pressure transmitter were replaced with a more robust design.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
St. Lucie Unit 2	05000389	2013	- 001	- 01	Page 2 of 3

NARRATIVE

Description of the Event

On May 31, 2013 at 0712 EDT, St. Lucie Unit 2 was in Mode 1 at 40% reactor power when it was manually scrammed. Unit 2 was scrammed prior to securing the 2A1 Circulating Water Pump (CWP) due to high differential pressure on the debris filter system (DFS) as a result of an algae intrusion. At the time of the trip, the 2A2 Circulating Water Pump had been removed from service for maintenance.

Cause

A root cause evaluation determined that a debris backwash valve was installed incorrectly. Inadequate procedural guidance for reinstallation and verification of the debris backwash valve motor operator resulted in an indicated valve position that was opposite of actual valve position. An additional root cause identified that the flush water check valve design was not optimal for application in the DFS system. Internal binding of the check valve caused a false low differential pressure that prevented the DFS strainer from initiating a backwash and masked the problem with the debris backwash valve.

Analysis of the Event

The DFS is part of the Circulating Water System, which is designed to provide a heat sink for the main condenser under normal operating and shutdown conditions. The DFS removes debris from the circulating water coolant supplied to the main turbine condenser to prevent clogging of tubes at the condenser tubesheet.

The DFS backwash line removes debris from the strainer sections by connecting the debris removal rotor bucket to the CWP discharge line. The incorrectly installed debris backwash valve degraded the backwash function of the DFS by restricting flow through this line. As the DFS became clogged due to the degraded backwash function, the Differential Pressure Monitoring System (DPMS) was also degraded and masked the increased differential pressure.

The DPMS monitors the build-up of debris on the filter elements. The DPMS has a flush system to ensure that debris does not clog the differential pressure nozzles of the strainer. Each DPMS independently flushes when a high differential pressure is detected.

The DPMS flush water check valves of the 2A1 waterbox stuck in the open position resulting in a false low indication on the DFS differential pressure transmitter that prevented the DFS strainer from starting the automatic backwash cycle. If DFS differential pressure increases excessively, the rotating nozzle "vacuum" design backwash function becomes ineffective and the DFS and Circulating Water Pump must be removed from service to backflow and unclog the filter.

There is a tight clearance between the poppet and the internal bore for the flush water check valve. This made the valve susceptible to binding as a result of debris, crud, and/or corrosion product build-up.

Safety Significance

A risk assessment associated with Unit 2 unplanned manual reactor trip event due to intake intrusion (algae influx) was developed. The Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) values were evaluated for the stated event and were found to be significantly below the thresholds required by RG-1.174 for the risk to be "Very Small," where CCDP is below 1.0E-06 and CLERP is below 1.0E-07. Therefore, it is concluded that the risk impact of the stated event is Very Small.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
St. Lucie Unit 2	05000389	2013	- 001 -	01	Page 3 of 3

NARRATIVE

This reactor trip event is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as a manual actuation of reactor protection system (RPS). This event had no significant safety consequence. All safety related systems functioned as designed. There were no safety systems actuations as a result of the trip. Given the response of the plant and the actions taken, the health and safety of the public was not affected by this event.

Corrective Actions

The corrective actions listed below are entered into the site corrective action program. Any changes to the actions will be managed under the corrective action program.

1. Replaced the DPMS flush water check valves with a more robust design to be more reliable.
2. Revised the preventative maintenance for the DFS to establish a replacement frequency of once per operating cycle for DFS flush water check valves.
3. Revise maintenance procedures to ensure proper valve position relative to operator position following maintenance of 90 degree valves such as butterfly valves and ball valves.

Similar Events

A similar event occurred at St. Lucie on April 1, 2009 involving ingress of algae. St. Lucie has experienced similar plant trips as a result of intake and jelly fish intrusion and/or related equipment failures. Prior troubleshooting did not identify binding of the DPMS flush water check valves as a possible degradation mechanism.

A review of nuclear industry events also identified several similar events associated with traveling water screens and intake system blockage/intrusion resulting from algae and intake debris.

Failed Component(s)

Flush Water Check Valve

MV-21-6A1, Debris backwash valve for Debris Filter DF-21-2A1

Manufacturer

The DPMS design was part of the original Taprogge modification to install the DFS strainers.

The flush water check valves are Nupro stainless steel poppet check valves (Part number SS6C4-1).

The debris backwash valve is a Henry Pratt MKII 14-inch butterfly valve with a Limitorque LY-2001 motor operator.